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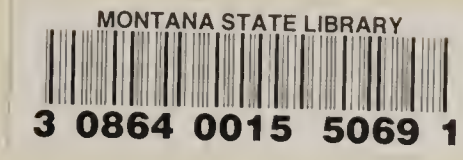

MONTANA ECONOMIC/DEMOGRAPHIC PROJECTIONS

A Report In Partial Fulfillment of Contractual Requirements For The

Montana Energy Model

Energy-Related Feasibility Study and an

Environmental Impact Statement for Re-use

of Glasgow Air Force Base in Valley County, Montana

for the

Old West Regional Commission

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ABSTRACT

This report documents projections of Montana's economic and demographic conditions through the year 2000 for inclusion in the Montana Energy Model. Employment data are disaggregated for the Utilities/Communication sector, and basic employment projections are provided by sector. Non-basic employment is disaggregated and projections provided. Economic sector output is defined and related to input/output basic linkages.

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I. INTRODUCTION

This report sets forth data from which economic and demographic projections were determined for inclusion in the Montana energy model. The rationale utilized in the development of the projection is discussed in detail. Employment projections include both basic and non-basic employment. Output and production projections are discussed by economic sector. Employment linkages and model parameters are also discussed.

II. EMPLOYMENT DATA

Employment data for the period from 1960 to 1977 (by sector) are summarized in Table 1. With the exception of non-agricultural proprietors, all data is from the 790 Employment Security Series, Research Division, Helena, Montana. Non-agriculture proprietor employment estimates (1960-66; 1976-77) were made using simple ratios of non-basic employment to basic employment data, 1967-75.

All information is sound and as accurate as any state economic data available. Data for 1977 are, however, preliminary and subject to revision.

A. Disaggregation of Utilities/Communications Sector

Time series data do not exist for electric utilities since neither the 790 Employment Security Series nor the BEA series is disaggregated to this degree. Estimated current employment (1977) for this sector is approximately 550. Communications employment is estimated to be 4,400 and other utilities at 2,850. These estimates are based on the BEA series

Table 1.--Employment in Montana

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
Agriculture	39.0	37.3	38.2	38.3	36.6	35.2	37.1	37.3	33.6	34.1	36.1	35.0	33.1	36.3	38.8	34.8	33.4	35.7
Lumber & Wood Products	7.3	7.4	8.0	8.5	8.4	8.6	8.9	8.7	8.9	8.9	8.2	8.7	9.2	9.8	9.5	8.1	9.1	9.3
Primary Metals	3.8	3.6	3.5	3.2	3.3	3.6	3.9	3.2*	3.7	4.6	4.7	4.1	3.9	3.4	3.4	3.3	3.2	3.2
Food Products	4.3	4.3	4.4	4.4	4.5	4.3	4.3	4.4	4.3	4.3	4.3	4.2	4.2	4.3	4.1	3.5	3.8	4.0
Refining	0.9	1.0	1.0	1.2	1.2	1.1	1.0	1.0	1.0	0.9	1.1	1.0	1.1	1.1	1.1	1.1	1.3	1.1
Other Manufacturing	2.4	2.4	3.5	3.5	2.5	2.9	3.1	3.4	3.6	3.6	3.8	4.1	4.2	4.3	4.5	4.2	4.2	4.6
Metal Mining	4.5	4.2	3.8	4.1	4.8	4.6	4.8	3.2*	2.3*	3.3	4.0	2.9*	3.7	3.8	4.0	3.1	2.4	2.0
Coal	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.2	0.3	0.3	0.4	0.7	0.9	0.9
Non-Metal Mining	0.7	0.7	0.8	0.9	0.9	1.1	1.1	1.0	1.0	0.8	0.8	0.7	0.7	0.8	0.9	0.8	0.6	0.7
Oil & Gas Extraction	2.2	2.2	2.2	2.1	1.9	1.8	1.7	1.7	2.2	2.3	1.8	1.6	1.6	1.6	1.8	1.8	2.0	2.5
Heavy Construction	2.8	4.0	4.7	4.1	4.1	4.5	4.3	4.1	4.9	4.6	4.7	5.1	3.5***	4.0	3.3	3.8	3.8	4.7
Rail Transportation	9.0	8.4	8.1	7.9	7.7	7.5	7.5	7.2	6.9	6.8	6.6	6.4	6.4	6.3	6.5	6.1	6.1	6.3
Federal Government	9.9	10.9	11.5	12.0	11.8	12.1	12.4	12.7	12.3	12.0	11.9	11.9	12.3	12.2	12.9	14.2	13.7	14.1
TOTAL BASIC	86.8	86.4	89.7	90.2	87.7	87.3	90.1	87.9	84.7	86.2	88.0	85.9	84.2	88.2	91.2	85.5	84.5	89.1
Other Construction	8.2	7.3	7.9	8.2	7.3	7.5	7.3	7.6	6.6	5.9	6.3	6.6	7.9	9.0	10.2	8.3	9.7	11.0
Other Transportation	4.0	3.9	3.9	3.8	3.8	4.0	4.1	4.4	4.5	4.6	4.6	5.0	5.1	5.7	6.0	5.6	5.7	6.1
Utilities and Communications	6.0	6.0	5.9	5.9	5.9	6.0	6.1	6.2	6.2	6.2	6.2	6.3	6.4	6.7	7.0	7.3	7.4	7.8
Trade	40.5	39.8	40.3	41.1	41.7	42.9	44.2	44.5	45.5	47.0	48.1	50.1	53.5	56.3	58.8	59.1	63.0	66.1
Services (including publishing)	24.8	25.1	25.7	25.9	26.6	28.0	29.1	30.6	32.3	33.9	35.5	37.2	39.2	42.3	44.3	46.2	49.7	51.4
Finance	6.9	6.8	6.8	6.8	6.9	7.0	7.2	7.2	7.6	7.9	8.1	8.5	9.0	9.4	10.0	10.2	10.6	11.4
State and Local Government	28.6	29.1	29.7	31.0	32.9	33.8	35.7	39.1	41.0	40.1	40.7	42.5	43.1	43.2	45.3	50.7	52.0	56.1
Non-Farm Proprietors	22.8	22.7	23.1	23.5	24.0	24.8	25.7	26.3	26.5	29.8	30.2	31.3	32.6	32.5	32.6	32.6	35.7	38.5
TOTAL NON-BASIC	141.8	140.7	143.3	146.2	149.1	154.0	159.4	165.9	170.2	175.4	179.7	187.5	196.3	205.1	214.2	220.0	233.8	248.4
TOTAL EMPLOYMENT	228.6**	227.1	233.0	236.4	236.8	241.3	249.5	253.8	254.9	261.6	267.7**	273.4	281.0	293.3	305.4	305.5**	318.3	337.5

Sources: Montana Employment Security, Research Division
U.S. Department of Commerce, Regional Economic Information System

* Strike
** Recession
*** Libby Dam

combined with 790 data and County Business Patterns (Department of Commerce). These estimates are believed to be as reliable as possible. The Employment Security Division can not verify these estimates,nor provide additional data as a result of federal disclosure regulations.

Until recently, we were unaware of this data limitation. To disaggregate further, simple ratios would be appropriate in most cases--based on historical national patterns. That is, multiply the projections (next section) for the entire sector by .071 for electric utilities, by .562 for communications, and by .367 for other utilities.

B. Employment Projections

All projections contained in this section are subjective with the projections based either on trend or personal insight. In many cases, the basic projections are the result of recent conversations with other economists or business representatives who are closely associated with specific sectors. However, the projections are as accurate as possible given the time span involved. Furthermore, the resultant non-basic and population projections are quite plausible.

The non-basic and population projections (Table 2) were derived by determining "likely" levels of future employment in the basic sectors. The sum of the basic projections was used to develop both the non-basic and population projections by way of a series of moving multipliers. These multipliers (see Section 6) were designed to produce plausible non-basic and population totals while maintaining internal consistency within the overall system. The goal was to project the multipliers in such a way as to reflect the following essential effects.

1. Historically, basic employment levels in Montana, and in the nation as well, have remained relatively constant. (When making long-run projections periodic business cycle fluctuations must be discounted.) Even though basic employment has been stable, non-basic employment and population have increased. It is assumed that this relationship will continue since population levels are not related to employment and since productivity increases in the basic sectors have nearly always exceeded non-basic gains.
2. Labor force participation has increased as result of direct demographic influences and the desire or need for females to enter the labor force. It is believed that the dramatic increase in female participation has been the result of both greater independence and the necessity to supplement family income in response to the increased cost of living. The dual argument, which also is reasonable, suggests that as aggregate participation increased, income increased resulting in greater demand for non-basic employment. The arguments are inseparable.

Both the logic and algebra of the system are simplistic. The primary assumption is that basic employment levels actually determine non-basic employment and population. (The historical and projected parameters linking these variables are included in Section 6.) For example, a <u>permanent</u> increase in basic employment is assumed to increase both non-basic employment and population by some multiple. The specific equations are shown on the following page.

Table 2.--Employment and population projections
(thousands)

Sector	1980	1985	1990	1995	2000
Agriculture	35.0	34.0	33.0	32.0	31.0
Lumber and Wood Products	9.5	9.8	10.0	10.0	10.0
Primary Metals	3.2	3.0	2.8	2.6	2.4
Food Products	4.1	4.0	3.9	3.8	3.7
Refining	1.1	1.1	1.1	1.1	1.1
Other Manufacturing	5.1	5.7	6.4	7.0	7.7
Metal Mining	2.0	2.0	2.5	2.5	3.0
Coal Mining	1.2	1.7	1.9	1.9	1.9
Other Mining	.8	.8	.8	.8	.8
Oil and Gas Extraction	2.5	2.5	2.5	2.5	2.5
Heavy Construction	4.2	4.2	4.2	4.2	4.2
Railroads	6.3	6.3	6.3	6.3	6.3
Federal Government	14.2	14.7	15.4	16.2	16.8
Total Basic	89.2	89.8	90.8	90.9	91.4
Other Construction	10.3	11.4	12.5	13.6	14.6
Other Transportation	6.9	7.7	8.6	9.3	10.0
Utilities and Communications	8.0	8.2	8.6	9.3	10.0
Trade	73.4	81.1	90.8	98.9	106.0
Services	58.9	67.2	76.4	83.2	89.2
Finance, Insurance, Real Estate	12.3	13.7	15.3	16.7	17.6
State and Local Government	56.3	61.1	68.2	74.4	79.8
Non-Farm Proprietors	40.6	44.1	49.2	53.7	57.6
Total Non-Basic	266.7	294.5	329.6	359.1	384.8
Population	783.2	822.6	869.9	909.9	952.4

Figure 1.--Employment projections
(thousands)

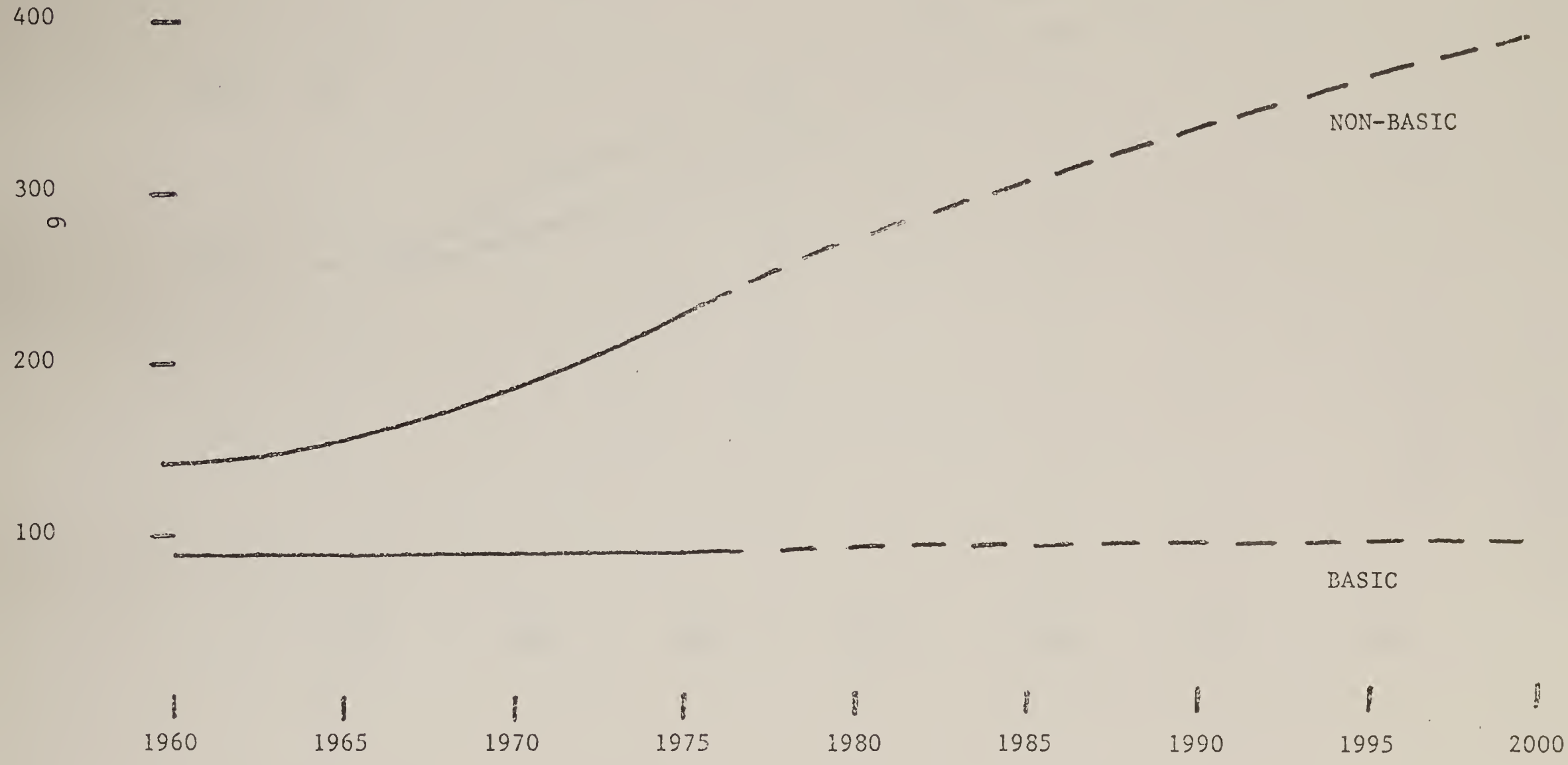
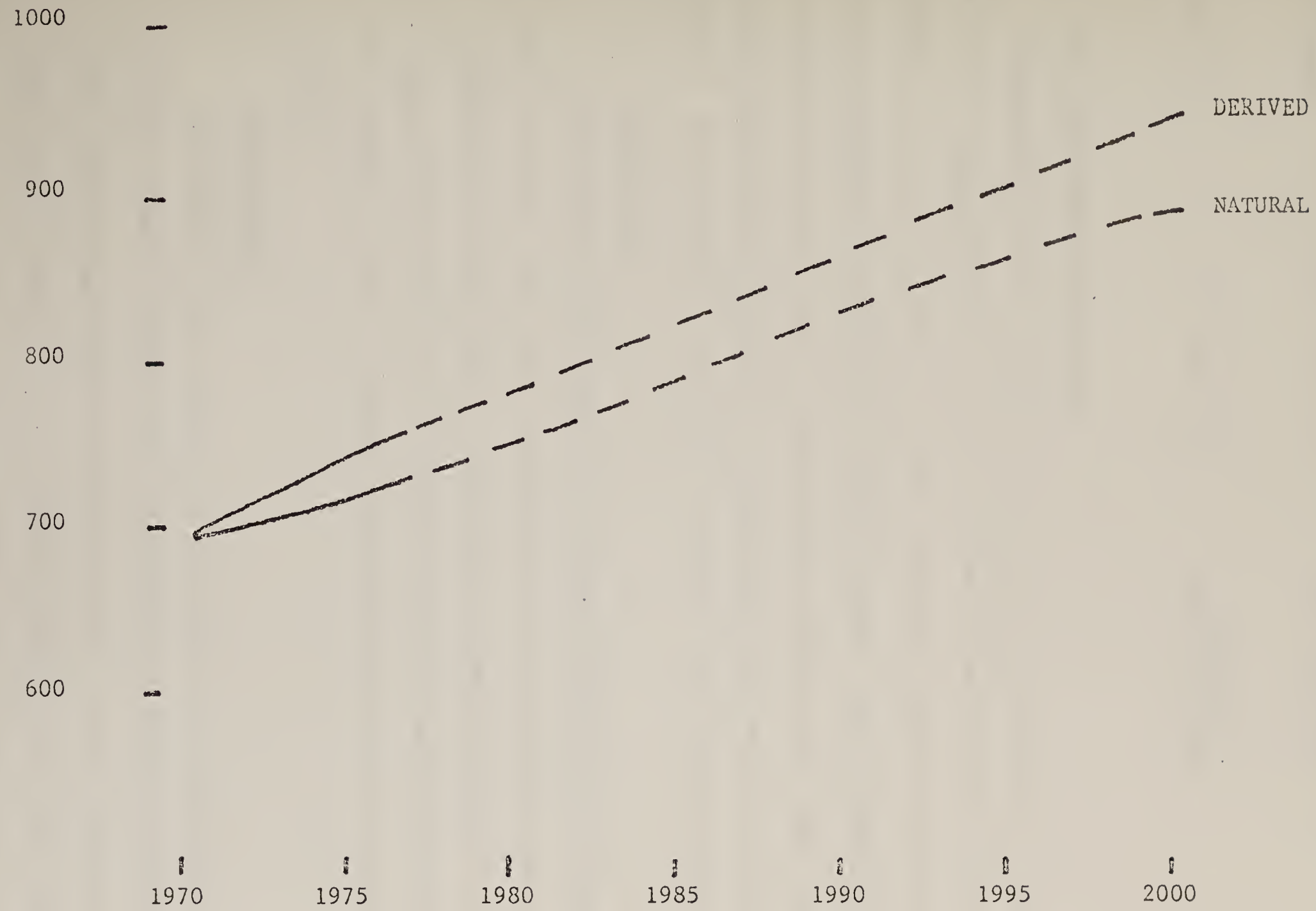


Figure 2.--Population projections
(thousands)



$$\text{Non-Basic Employment} = \text{Basic Employment} \times \frac{\text{Total Employment}}{\text{Basic Employment}} - 1$$

$$\text{Population} = \text{Total Employment} \times \frac{\text{Population}}{\text{Total Employment}}$$

C. Basic Employment Projections

As mentioned earlier, the basic projections are subjective. It was originally anticipated that project employment (when feasible) could be defined as a direct function of specific output and productivity forecasts. This was not entirely possible for several reasons. Only limited data were available for the agricultural, wood products, mining, and primary metals sectors; when data were available, the employment data were not product-specific. This problem is discussed in Sections 3 and 4 of the report.

1. Agriculture

Employment in this sector is likely to decline in the future, as in the past. Only minor increases in cattle marketings and grain production are anticipated. Coupled with increasing productivity (i.e., capital intensity and improved management techniques), this will probably result in further employment reductions (see Sections 3 and 4).

2. Wood Products

Employment in this industry is influenced in a large measure by national income, interest rates, and credit availability. Representatives of the industry have expressed doubt over the fact that employment will exceed the 1973 level, i.e., the greatest housing cycle peak ever experienced. During this "boom period" statewide employment briefly

reached 10,000 workers. This view also is supported by declining timber availability, increased restrictions on logging, and inlarged wilderness areas. Some expansion in processed materials such as plywood and particle board output is expected. Additionally, many long-term national construction projections are optimistic. Nevertheless, actual timber harvest is likely to remain relatively stable in the future.

3. Primary Metals

Output data are not available for this sector; it is therefore assumed that the historical employment decline will continue even though mining activity may increase. It is unlikely that any employment gains in this industry will result.

4. Metal Mining

Several new mines are likely to open within the next decade; permits have already been filed. In addition to newly-discovered copper and zinc deposits, some potential exists for expanded chromium and iron extraction. As a result, the historical decline in this section is not expected to continue. It is projected that employment will gradually grow. Actual output is, however, likely to expand more rapidly than employment as a result of technological advances.

5. Food Products

The projections for this sector are the result of a simple time trend. The declines experienced since 1960 are anticipated to continue into the future as well.

6. Refining

Employment in this sector has been very stable and, as a result, it has been assumed to be a constant over the projection period, assuming no significant input supply bottlenecks, i.e., ample crude feeder stock.

7. Other Manufacturing

This aggregate sector has experienced considerable growth in the past and its is expected this trend will continue.

8. Non-Metal Mining

Growth in this sector (essentially sand and gravel extraction) is not likely.

9. Oil and Gas

Accurate projections for this industry are nearly impossible. Many of the fields presently in operation are in declining areas. New exploration is in progress in western Montana, and as a result, employment in this sector was constant at the 1977 level.

10. Heavy Construction

Major variations in this sector have been related to dam and highway construction projects. The projections represent a simple long-term employment average. No major expansion is expected at least within the next few years.

11. Rail

Employment by the railroads is expected to stabilize at the current level.

12. Federal Government

If past trends hold, this sector will increase substantially. Another potential influencing factor is the closing of the military base at Great Falls.

13. Coal

The employment projections for the coal industry were produced using a constant output/employment ratio and relatively low coal output levels (see Sections 3 and 4). The effect of environmental restraints and energy policy are uncertain.

D. Disaggregation of Montana Non-basic Employment Projections

Non-basic employment projections for Montana were disaggregated on the basis of historical trends (1960-75) and subjective considerations of possible changes in these trends. Each of the sector projections are discussed briefly.

1. Other Construction

Three-year averages centered on 1960, 1965, 1970, and 1975 were used to establish 1960 to 1975 growth trends. These data are presented in Table 3.

Table 3.--Other construction employment

(3-year averages)

	1960	1965	1970	1975
Employment (000's)	7.8	7.4	6.3	9.4
Percent of Non-basic	5.5	4.8	3.5	4.2
Growth (annual rate)	n/a	-1.0	-3.0	9.8

The average annual growth rate for this sector (1960-75) was 1.4 percent. Employment actually decreased to 6,300 in 1970 and then rebounded to 9,400 in 1975. Current indications are that employment in this sector is showing rapid growth, and future prospects for growth appear good, i.e., long-range national housing construction projections. For this reason, an annual growth rate of approximately two percent was assumed throughout the projection period.

2. Other Transportation

Annual growth rates for this sector have averaged about three percent since 1960. This stable growth trend is assumed for the projection period.

3. Utilities and Communications

Annual employment growth from 1960 to 1975 averaged 1.3 percent per year. Table 4 illustrates this growth as well as the percent of total non-basic employment.

Table 4.--Utilities and communications employment

	1960	1965	1970	1975
Employment (000's)	6.0	6.0	6.2	7.2
Percent of Non-basic	4.3	3.9	3.4	3.2
Growth (annual rate)	n/a	0.0	0.7	3.2

Employment in this category was stable until 1970. Most of the growth occuring since 1970 was attritable to increases in communications and public utilities, not electrical generation. Current indications are that this sector will continue to grow at a rate slightly greater than the 1960-75 rate. A growth rate of two percent was assumed for

the projection period. This assumption is supported by long-term growth levels anticipated by Mountain Bell, which comprises nearly fifty percent of the total sector employment.

4. Trade

Employment in this sector grew at an annual rate of roughly three percent since 1960. This growth rate is anticipated to continue in the future.

5. Services

Because of the rapid expansion that occurred in this sector since 1970, extreme caution was used in projecting long-range patterns. Table 5 reveals this unusual growth.

Table 5.--Service employment

	1960	1965	1970	1975
Employment (000's)	25.0	27.9	35.5	46.7
Percent of Non-basic	17.7	18.1	19.6	21.0
Growth (annual rate)	n/a	2.3	5.4	6.3

The current growth rate is anticipated to continue until 1990. After 1990 the growth rate is assumed to equal that of total non-basic employment. The average growth rate for the entire projection period is slightly less than the 1960-75 increase.

6. Finance, Insurance, Real Estate

Growth in this sector is expected to slow somewhat when compared to historical trends; this is indicated by an assumed growth rate of 2.8 percent for the projection period compared to the historical growth of 3.3 percent.

7. State and Local Government

The average annual growth rate for employment in state and local government was 4.7 percent since 1960. Most of this growth has occurred since 1970. Increases of this magnitude are not expected in the future. An average rate of 2.5 percent was assumed for the projection period. Most of the growth is likely to be found in local government and not the state government sector.

8. Non-Farm Proprietors

Growth in this sector is expected to slow somewhat when compared to the 1960-1975 increase. An assumed rate of 2.8 percent was used for this sector.

9. Adjustments

When the growth rates were applied to 1975 employment data and adjusted to the historical percent of total non-basic employment (as applicable), a total was calculated by adding employment in all sectors (Table 6). If the sum deviated from the projected total, an adjustment factor was calculated using the two totals. This factor was applied to all non-basic sectors so that both projections were equal.

E. Construction Worker Impacts

Temporary workers associated with construction projects, etc., have little if any effect on non-basic employment. This has been the case in Montana as well as in other areas of the nation. Previous reviews by Western Analysis and by the Bureau of Economic Analysis, Salt Lake, support this conclusion. In other words, non-basic or derived population multipliers cannot be used to simulate the impacts of short-term events such as

Table 6.--Percent of non-basic employment
(1980-2000)

Sector	1980	1985	1990	1995	2000
Other Construction	3.9	3.9	3.8	3.8	3.8
Other Transportation	2.6	2.6	2.6	2.6	2.6
Utilities and Communications	3.0	2.8	2.6	2.6	2.6
Trade	27.5	27.5	27.5	27.5	27.5
Services	22.1	22.8	23.2	23.2	23.2
Finance, Insurance, Real Estate	4.6	4.6	4.6	4.6	4.6
State and Local Government	21.0	20.7	20.7	20.7	20.7
Non-Farm Proprietors	15.2	15.0	14.9	15.0	15.0

Note: totals may not add to 1.00 due to rounding

construction. Since most construction workers are relatively young, an average family-household size of 2.28 (based on The Construction Worker Profile, Old West/Four Corner's Regional Areas, 1976) provides greater accuracy than the 1970 census dependency ratios.

Foreward:

These two sections presented several unanticipated problems; problems which we should have been aware of prior to the development of the work plan. First, data restrictions or the lack of data made the construction of productivity ratios very difficult. Second, while national information was available, both the national trends and projections of output/employment indices were generally not appropriate for use in Montana. The national technology was nearly always very different. These issues will become clear in the following discussion.

III. ECONOMIC SECTOR OUTPUT

A. Agricultural Output

Cattle and calf production (Table 7) is measured in total live weight of marketings adjusted for on-farm slaughter/consumption, live weight of in-shipments, and inventory changes. Historically, there is no stable time trend in output. Production increased during the 1960's, and in the assumption that the recent decrease in output was the result of increased culling (the most recent cattle cycle) as a result of unstable prices, production should again increase when prices stabilize. These represent the primary assumptions underlying the output projections. The projections are generally consistent with the national outlook. For additional background, see Agricultural Forecasts, Chase Econometrics, which project an annual expansion of about two percent per year. The Chase projections are about one half the projected (national) production levels reported in the 1972 OBERS series. We expect that nearly all of the increase in Montana will be due to out-shipments of yearlings for feedlots in the Midwest. The expansion of in-state feeding operations is not likely for a variety of reasons, i.e., climate, transportation costs, and feed grain supplies.

It should be noted that the cattle and calf inventory for January, 1978, was down about 14 percent since last year. This trend is expected to reverse within the next year as a result of lower grain prices (corn, sorghum) and increasing fat cattle prices. Inventory levels are anticipated to rise (to the early 1970 figure) by 1985.

Since employment data relating directly to livestock production are not available it is impossible to construct a 'true' output/employment index for this category. Instead, indices were computed for the total agricultural sector employment based on beef production per animal. This series was developed by simply dividing the production relative to total employment based on the 1967 relationship of one. There are no definitive trends; the assumed growth represents an increase in the ratio of about five percent per year. We suggest that extreme caution be used since the projections are the result of individual subjectivity. No national data of this detail were available; however, the indices are plausible in that they fit the past pattern. This alone warrents consideration in their usage.

Wheat and barley production data as well as the number of acres harvested is contained in Table 7. Historically, production per acre has increased. Part of the increase was probably due to favorable moisture conditions for the last several years of the series. However, some of the increase can be attributed to improved procedures as well as improved strains. This technological assumption is the primary reason for projected increases.

Three-year averages of yield-per-acre were developed for both wheat and barley. The historical growth rates are assumed to remain constant over the entire period (1977-2000). This assumption results in increased wheat yields from 26.5 bushels per acre in 1980 to 30.0 in the year 2000. Total wheat acres harvested is expected to drop to 4.5 million by 1980 and then remain constant. Total barley acres harvested is expected to average

Table 7.--Montana agricultural output

	Cattle and Calves		All Wheat		Barley	
	Production (000 lbs.)	Number[1] (000 head)	Production (000 bu.)	Harvested (000 acres)	Production (000 bu.)	Harvested (000 acres)
1960	789,875	2245	79,397	4088	40,444	1721
1961	742,180	2155	54,048	4262	26,370	1465
1962	737,845	2133	79,332	4248	54,961	1802
1963	828,865	2325	92,294	4246	44,663	1514
1964	927,420	2672	93,752	4156	49,692	1529
1965	948,420	2758	105,350	4551	50,050	1300
1966	985,385	2841	99,694	3885	63,564	1651
1967	973,940	2869	119,136	4825	37,022	1255
1968	1,062,930	2984	125,869	4722	42,735	1155
1969	1,066,560	2984	99,754	3920	67,914	1617
1970	1,089,015	3014	85,167	3506	65,132	1714
1971	1,122,103	3165	112,011	4516	58,800	1680
1972	1,103,350	3165	98,831	4130	64,013	1707
1973	1,053,550	3197	93,714	4235	60,000	2000
1974	1,035,930	3380	120,108	5020	37,120	1280
1975	963,050	3340	155,925	5130	50,700	1300
1976	974,090	3150	167,295	5415	52,065	1120
1977	920,820	2980	130,920	5060	55,480	1520
1980	910,000	2600	119,250	4500	54,000	1500
1985	997,500	2850	123,300	4500	55,500	1500
1990	1,102,500	3150	127,350	4500	57,000	1500
1995	1,120,000	3200	130,950	4500	58,500	1500
2000	1,120,000	3200	135,000	4500	60,000	1500

Source: Montana Agricultural Statistics, Montana Department of Agriculture

[1] Inventory beginning of year

Table 8.--Montana agricultural employment and output indices
(1967 = 100)

	Employment		Cattle & Calf Production		All Wheat		Barley	
	Number	Index	Per Animal	Index	bu/acre	Index	bu/acre	Index
1960	39.0	104.6	351.8	103.7	19.4	78.5	23.5	79.7
1961	37.3	100.0	344.4	101.5	12.7	51.4	18.0	61.0
1962	38.2	102.4	345.9	101.9	18.7	75.7	30.5	103.4
1963	38.3	102.7	356.5	105.0	21.7	87.9	29.5	100.0
1964	36.6	98.1	347.1	102.3	22.6	91.5	32.5	110.2
1965	35.2	94.4	343.9	101.3	23.2	93.9	38.5	130.5
1966	37.1	99.5	346.8	102.2	25.7	104.0	38.5	130.5
1967	37.3	100.0	339.4	100.0	24.7	100.0	29.5	100.0
1968	33.6	90.1	356.2	104.9	26.7	108.1	37.0	125.4
1969	34.1	91.4	357.4	105.3	25.5	103.2	42.0	142.4
1970	36.1	96.8	361.3	106.5	24.3	98.4	38.0	128.8
1971	35.0	93.8	354.5	104.4	24.8	100.4	35.0	118.6
1972	33.1	88.7	348.6	102.7	23.9	96.8	37.5	127.1
1973	36.3	97.3	329.5	97.1	22.1	89.5	30.0	101.7
1974	38.8	104.0	306.5	90.3	23.9	96.8	29.0	98.3
1975	34.8	93.3	288.3	84.9	30.4	123.1	39.0	132.2
1976	33.4	89.5	309.2	91.1	30.9	125.1	44.5	150.8
1977	35.7	95.7	309.2 E	91.1	25.9	104.9	36.5	123.7
1980	35.0	93.8	350.0	103.1	26.5	107.3	36.0	122.0
1985	34.0	91.2	350.0	103.1	27.4	110.9	37.0	125.4
1990	33.0	88.5	350.0	103.1	28.3	114.6	38.0	128.8
1995	32.0	85.8	350.0	103.1	29.1	117.8	39.0	132.2
2000	31.0	83.1	350.0	103.1	30.0	121.5	40.0	135.6

Source: Developed from the preceding table

Table 9.--Montana agricultural output and employment ratios

	Cattle & Calf Production	All Wheat Production	Barley Production
1960	99.1	75.0	76.2
1961	101.5	51.4	61.3
1962	99.5	73.9	101.0
1963	102.2	85.6	97.4
1964	104.3	93.3	112.3
1965	107.3	99.5	138.2
1966	102.7	104.5	131.2
1967	100.0	100.0	100.0
1968	116.4	119.9	139.2
1969	115.2	112.9	155.3
1970	110.0	101.7	133.1
1971	111.3	107.0	126.4
1972	115.8	109.1	143.3
1973	99.8	92.0	104.5
1974	86.8	93.1	94.5
1975	91.0	131.9	141.7
1976	101.8	139.8	168.5
1977	95.2	109.6	129.3
1980	109.9	114.4	130.1
1985	113.1	121.6	137.5
1990	116.5	129.5	145.5
1995	120.2	137.3	154.1
2000	124.1	146.2	163.2

Source: Developed from the preceding table

Table 10.--Montana lumber employment and output

	Employment		Production		Productivity
	(000's)	Index	Board Ft.*	Index	Index
1960	7.3	83.9	1035	76.8	91.5
1961	7.4	85.1	1152	85.5	100.5
1962	8.0	92.0	1259	93.4	101.5
1963	8.5	97.7	1166	86.6	88.6
1964	8.4	96.6	1271	94.4	97.7
1965	8.6	98.8	1311	97.3	98.5
1966	8.9	102.3	1375	102.1	99.8
1967	8.7	100.0	1347	100.0	100.0
1968	8.9	102.3	1499	111.3	108.8
1969	8.9	102.3	1397	103.7	101.4
1970	8.2	94.3	1281	95.1	100.9
1971	8.7	100.0	1397	103.7	103.7
1972	9.2	105.7	1311	97.3	92.1
1973	9.8	112.6	1445	107.3	95.3
1974	9.5	109.2	1165	86.5	79.2
1975	8.1	93.1	1038	77.1	82.8
1976	9.1	104.6	1197	88.9	85.0
1980	9.5	109.2	1200	89.1	81.6
1985	9.8	112.6	1250	92.8	82.4
1990	10.0	114.9	1250	92.8	80.8
1995	10.0	114.9	1250	92.8	80.8
2000	10.0	114.9	1250	92.8	80.8

*note: the production figure is measured in millions of board feet of cut lumber and does not include processed materials.

1.50 million acres. These levels are consistent with the historical harvestings. Furthermore, these projections are consistent with both the Montana OBERS series and national forecasts prepared by Chase.

Wheat and barley indices (Tables 8 and 9) were prepared exactly as the livestock indices. Caution is necessary in using these data since the ratios reflect past weather patterns and prices.

B. Lumber Output

The only available source of physical output data is Western Wood Products Association, a private organization in Portland, Oregon. This output series, measured in millions of board feet, is presented in Table 10 along with long-term projections. The projections assume that production activity will increase to the 1970-76 average by 1985 and then remain constant throughout the remainder of the period. As evidenced by the historical data,this assumption seems plausible.

The historical and projected productivity parameters also are included in Table 10. The projected decline in productivity is not the result of change in technology, but rather the result of an assumed shift from cut lumber to processed materials. No output or employment information exists for plywood, paper, etc.

C. Metal Mining

Table 11 provides an overview of metal mining in Montana from 1960 to 1976 with projections from 1977 to 2000. Copper production has significantly varied since 1960. Even in view of the recent decline, there are no indications that output will decrease further. In fact, most long-term projections (OBERS, Chase, ect.) call for moderate increases in output over

Table 11.--Montana mineral production

Year	Recoverable Copper (short tons)	Gold (troy ounces)	Recoverable Zinc (short tons)
1960	91,972	n/a	n/a
1961	104,000	35,377	10,262
1962	94,021	24,387	37,678
1963	79,762	18,520	32,941
1964	103,806	29,115	29,059
1965	115,489	22,722	33,786
1966	128,061	25,009	29,120
1967	65,483	9,786	3,341
1968	69,480	13,385	3,778
1969	103,314	24,189	6,143
1970	120,412	22,456	1,457
1971	88,581	15,613	361
1972	123,110	23,725	12
1973	132,446	27,806	73
1974	131,131	28,268	136
1975	87,959	17,259	110
1976	91,111	24,075	64
1977[P]	89,000	24,100	75
1980	100,000	22,000	100
1985	105,000	22,000	100
1990	115,000	22,000	100
1995	120,000	22,000	100
2000	120,000	22,000	100

Data Source: U.S. Department of Interior, Bureau of Mines, Minerals Yearbook.

Table 12.--Montana productivity ratios for mineral production

Year	Employment		Copper		Gold		Zinc	
	(000s)	Index	Index	Ratio	Index	Ratio	Index	Ratio
1960	4.5	140.6	140.5	99.9	-	-	-	-
1961	4.2	131.3	158.8	121.1	361.5	275.7	307.2	234.2
1962	3.8	118.8	143.6	120.9	249.2	208.0	1127.8	949.3
1963	4.1	128.1	121.8	100.0	189.2	155.3	986.0	809.5
1964	4.8	150.0	158.5	105.7	297.5	198.3	869.8	579.9
1965	4.6	143.8	176.4	122.7	232.2	161.5	1011.3	703.3
1966	4.8	150.0	195.6	130.4	255.6	170.4	871.6	581.1
1967	3.2	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1968	2.3	71.9	106.1	147.6	136.8	190.3	113.1	157.3
1969	3.3	103.1	157.8	153.1	247.2	239.8	183.9	178.4
1970	4.0	125.0	183.9	147.1	229.5	183.6	43.6	34.9
1971	2.9	90.6	135.3	149.3	159.5	176.1	10.8	11.9
1972	3.7	115.6	188.0	162.6	242.4	209.7	.3	.3
1973	3.8	118.8	202.3	170.3	284.1	239.1	2.2	.2
1974	4.0	125.0	200.3	160.2	288.9	231.1	4.1	3.3
1975	3.1	96.9	134.3	138.6	176.4	182.0	3.3	3.4
1976	2.4	75.0	139.1	185.5	246.0	328.0	2.2	2.5
1977	2.0	62.5	135.9	217.4	246.3	394.1	2.2	3.0
1980	2.0	62.5	152.7	225.0	224.8	224.0	3.0	3.0
1985	2.0	62.5	160.3	230.0	224.8	239.0	3.0	3.2
1990	2.5	78.1	175.6	230.0	224.8	256.0	3.0	3.4
1995	2.5	78.1	183.3	230.0	224.8	276.0	3.0	3.6
2000	3.0	93.8	183.3	230.0	224.8	299.0	3.0	3.8

Data Sources: Minerals Yearbook, Bureau of Mines
Employment Security, 790 Series

the next 20 years. This is also the case with the projections presented in this report. Production is expected to grow at an annual rate of about one percent from a base of 100,000 short tons in 1980. This increase is expected to continue until 1995 when production is assumed to remain constant.

Output/employment ratios (Table 12) are also expected to increase, but not as rapidly as in the past. The projections are largely based on judgement; that is, the values are somewhat lower than the trend level since the gradual closing underground operations will no longer play a role in the upward drift in productivity.

The production of gold has been fairly constant since 1960 and is projected to remain at about the 1975-77 level throughout the projection period. On the other hand, zinc production is off sharply from the levels of the middle 1960's. As a result, no future increases are projected.

The productivity levels for gold and zinc must be used with caution since employment in the mining sector is totally dominated by copper. These ratios fluctuate widely and little meaning can be attached to the variations. However, projected output/employment ratios for gold and zinc seem to be consistent with the historical ratios so that production and employment projections appear to be plausible.

D. Primary Metals Output

Production data for this sector are not available from published sources due to disclosure problems with the three largest producers. It is suggested that the following producers be contacted if production data are necessary:

1. Copper

The Anaconda Company
Anaconda, Montana 59711
E.S. Kranlick, Manager
406-563-5211

2. Aluminum

Anaconda Aluminum Company
Columbia Falls, Montana 59912
Richard Varhorn, President
406-892-3261

3. Lead

ASARCO
East Helena, Montana 59635
S.M. Lane, Manager
406-227-5311

E. Coal, Oil and Natural Gas Production

The coal production productions presented in this report (Table 13) show a large increase in mining activity to the year 1990 and then constant production to 2000. It is estimated that after 1990 environmental regulations will soften the demand for Western coal. While there are many estimates of future levels of coal production, the figures presented here represent about the average of the various independent projections.

The output/employment ratios for coal (Table 14) are expected to remain almost constant throughout the projection period. This assumption is plausible given the historical ratios.

Historically, natural gas production has fluctuated drastically from year-to-year and there appears to be no true production trend, even considering current national shortages. The projections for gas output (Table 13) are therefore set at approximately the average of the last three years. Given the current price and reserve level for gas, these projections might tend to be conservative.

There are no data available for gas production employment. Therefore, a combined oil and gas production employment level was used to develop the

productivity ratios. These projections are consistent with the employment projections presented earlier. The projected ratios are constant throughout the entire period and should be used with care given the inconsistencies in the employment patterns in this sector.

Oil production is projected to decline over the next 20 years. Most of the oil fields in Montana are fairly old and production decline curves fitted to output data from each of these fields indicate no future increases. These projections would be invalidated by the discovery of another Belle Creek or a major find in the overthrust belt. This sort of prediction is impossible, and a moderate decline is assumed.

Given constant employment over the period and declining output projections, the productivity ratios appear to be falling to levels inconsistent with the historical data. However, it should be noted that the employment data consists of both the oil and gas production categories so that any credence given to the output/employment ratios should be carefully scrutinized.

F. Input/Output Basic Employment Linkages

All employment linkages (Table 15) were derived from the 1975 Montana Input/Output table. It is important to realize that the original table was developed from secondary sources and therefore is not totally reliable. (See the MFP Report, Department of Community Affairs, Research Division, for more detail). In brief, the table was constructed using standard secondary procedures, i.e., the 1967 national 484 x 484 table scaled by 1972 202 Employment Security data. Every effort was made to ensure reasonable accuracy interviews, partial surveys, and other consistency checks with known import-export flows--represent examples.

Table 13.--Montana output of coal and petroleum products

Year	Coal* (million tons)	Natural Gas (Million cubic feet)	Crude Petroleum (1000.42 gallon barrels)
1960	n/a	n/a	n/a
1961	n/a	33,701	30,906
1962	n/a	29,955	31,648
1963	n/a	30,026	30,870
1964	n/a	25,188	30,647
1965	n/a	28,105	32,778
1966	n/a	30,685	35,380
1967	n/a	25,866	34,959
1968	n/a	19,313	48,460
1969	n/a	41,229	43,954
1970	n/a	42,705	37,879
1971	7.1	32,720	34,599
1972	8.0	33,474	33,904
1973	110.4	56,175	34,620
1974	13.6	54,873	34,554
1975	22.1	40,734	32,844
1976	26.2	42,563	32,814
1977	27.7	48,663	32,914
1980	40.0	45,000	32,000
1985	56.0	45,000	31,000
1990	63.0	45,000	30,000
1995	63.0	45,000	29,000
2000	63.0	45,000	28,000

Source: Coal; Research Division, Montana Department of Revenue
Oil and gas; U.S. Department of Interior, Bureau of Mines, Minerals Yearbook

Note: Various other projections are available from Old West, DNR, the University of Montana, MEAC (no longer in existence), Northern Powder River Basin Group, and the Northern Great Plains Commission.

Table 14.--Montana output and employment indices
coal and petroleum

Year	Employment			Production		
	Coal (1971=100)		Gas and Oil (1967=100)	Coal	Gas	Oil
1960	n/a		n/a	n/a	n/a	n/a
1961	n/a		129.4	n/a	130.3	88.4
1962	n/a		129.4	n/a	115.8	90.5
1963	n/a		123.5	n/a	116.1	88.3
1964	n/a		111.8	n/a	97.4	87.6
1965	n/a		105.9	n/a	108.7	93.8
1966	n/a		100.0	n/a	118.6	101.2
1967	n/a		100.0	n/a	100.0	100.0
1968	n/a		129.4	n/a	74.7	138.6
1969	n/a		135.3	n/a	159.4	125.7
1970	n/a		105.9	n/a	165.1	108.4
1971	(196)	100.0	94.1	100.0	126.5	99.0
1972	(300)	153.1	94.1	112.7	129.4	97.0
1973	(330)	168.4	94.1	146.5	217.2	99.0
1974	(445)	227.0	105.9	191.5	212.1	98.8
1975	(745)	380.1	105.9	311.3	157.5	94.0
1976	(860)	438.8	117.6	369.0	164.6	93.9
1977	(900)	459.2	147.1	390.1	188.1	94.1
1980	612.2		147.1	563.4	174.0	91.5
1985	867.3		147.1	788.7	174.0	88.7
1990	969.4		147.4	887.3	174.0	85.8
1995	969.4		147.1	887.3	174.0	83.0
2000	969.4		147.1	887.3	174.0	80.1

Source: Employment and output indices based on data from this report

Table 14.(cont.)--Montana output and employment indices
coal and petroleum

Year	Coal	Gas	Oil
1960	n/a	n/a	n/a
1961	n/a	100.7	68.3
1962	n/a	89.5	69.9
1963	n/a	94.0	71.5
1964	n/a	87.1	78.4
1965	n/a	102.6	88.6
1966	n/a	118.6	101.2
1967	n/a	100.0	100.0
1968	n/a	57.7	107.1
1969	n/a	117.8	92.9
1970	n/a	155.9	102.4
1971	100.0	134.4	105.2
1972	73.6	137.5	103.1
1973	87.0	230.8	105.2
1974	84.4	200.3	93.3
1975	81.9	148.7	88.8
1976	84.1	140.0	79.9
1977	85.0	127.9	64.0
1980	92.0	118.3	62.2
1985	90.9	118.3	60.3
1990	91.5	118.3	58.3
1995	91.5	118.3	56.4
2000	91.5	118.3	54.5

Table 15.--Direct basic employment linkages in Montana

	AGRICULTURE	LUMBER	OIL/GAS	METAL MINING	COAL	OTHER MINING	FOOD	REFINING	PRIMARY METALS	OTHER MFG.
AGRICULTURE	1.00						.76			
LUMBER		1.00								
OIL/GAS			1.00					1.12		
METAL MINING				1.00					.21	
COAL					1.00					
OTHER MINING				.06	1.00				.32	
FOOD	.01						1.00			
REFINING	.01							1.00		
PRIMARY METALS									1.00	
OTHER MFG.	.02			.01						1.00

Source: Derived from MFP-I/O table 1975, The Montana Futures Process, Department of Community Affairs, Research Division, Helena, Montana.

Input requirements (direct) in dollar terms were converted to employment using estimated 1972 output/employment ratios. Copies of the complete table are available from The Montana Department of Community Affairs. Any purchase greater than one percent of total purchases was assumed to be relevant.

With the exception of a few sectors, Montana has an essentially 'flow-through' economy. The high degree of aggregation requested contributes to this conclusion. Nevertheless, it is safe to assume that few linkages of any real significance exist. That is, most of the necessary inputs for production appear to be imported and do not constitute production of other internal sectors. Conversely, outputs are directly exported and not utilized internally.

Although Table 15 is as sound as possible, caution should be exerted in its use. For example, a reduction in the food processing industry would not realistically imply a decline in agricultural employment. Input/output tables reveal only linkages, not impacts.

IV. MODEL PARAMETERS

Historical and projected participation rates, basic/service ratios, and their interrelationships are provided in Table 16 and Figure 3. Projections of participation rates for Montana were made on the basis of anticipated long-term national levels by Chase Econometrics, Inc. After considerable investigation, Bureau of Labor Statistic (BLS) projections were abandoned since they appeared to be unrealistically low. The BLS projections indicated nearly no growth in overall rates even in view of

Table 16.--Aggregate participation rate projections

Year	National (Labor Force Base)	Montana** (Employment Base)
1970	60.0	38.6
1975	61.2	41.0
1980	63.6	45.4
1985	65.6	46.8
1990	67.7*	48.3
1995	69.2*	49.4
2000	70.0*	50.0

Source: National projections, Chase Econometric Associates, Inc., Long Term Macroeconomic Forecasts, November, 1977, Chapter 2.

Note: *Extrapolation of Chase trend modified with projected national demographic patterns, U.S. Bureau of the Census.

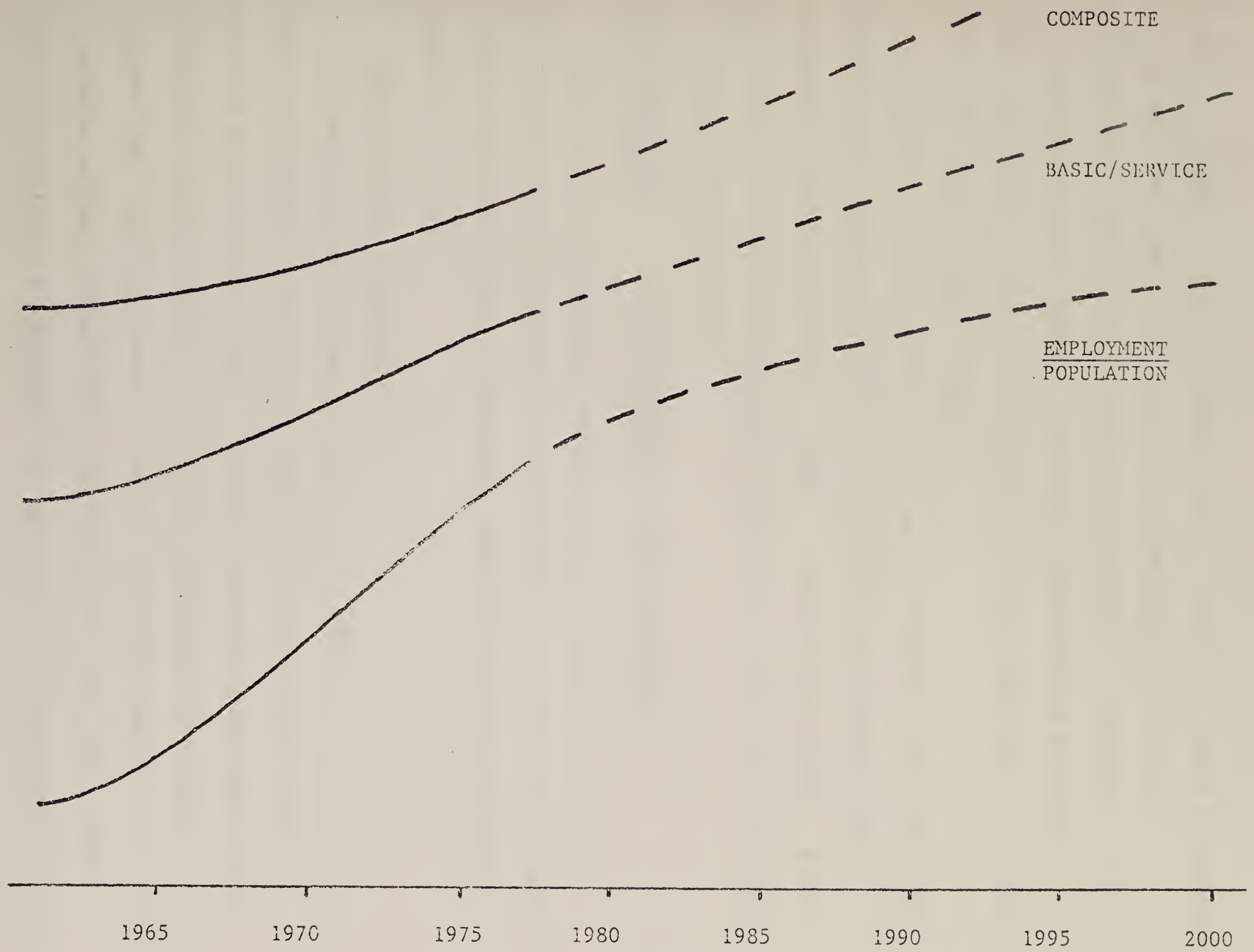
**Derived from national projections using 1977 as the base year.

Table 17.--Historical and projected parameters

Year	EMPLOYMENT POPULATION	BASE MULTIPLIER		EMPLOYMENT POPULATION	BASE MULTIPLIER
1960	.339	2.63	1981	.457	4.05
1961	.328	2.63	1982	.460	4.11
1962	.329	2.60	1983	.462	4.16
1963	.334	2.62	1984	.465	4.22
1964	.336	2.70	1985	.468	4.28
1965	.342	2.76	1986	.471	4.35
1966	.355	2.77	1987	.474	4.42
1967	.362	2.89	1988	.477	4.49
1968	.368	3.01	1989	.480	4.56
1969	.377	3.03	1990	.483	4.63
1970	.386	3.04	1991	.485	4.69
1971	.385	3.18	1992	.487	4.76
1972	.392	3.34	1993	.490	4.82
1973	.402	3.33	1994	.492	4.89
1974	.414	3.35	1995	.494	4.95
1975	.410	3.57	1996	.495	5.00
1976	.422	3.77	1997	.496	5.05
1977	.443	3.79	1998	.498	5.11
1978	.447	3.86	1999	.499	5.16
1979	.450	3.92	2000	.500	5.21
1980	.454	3.99			

Note: The base multiplier is equal to the basic/service ratio plus one. In other words, the base multiplier is the total employment multiplier.

Figure 3.--Aggregate participation rate projections



dramatic increases in the last several years. Presumably, these projections will be modified later. The Chase projections appear more plausible, embodying more likely trends in female rates as well as demographic effects. The Chase forecasts do, however, indicate a declining rate of growth, largely the result of the age characteristics of the population. This same effect will also influence Montana.

Projections of basic/service ratios were derived from long-term extrapolation of the composite multiplier, i.e., population divided by basic employment. This extrapolation is shown in the following diagram. Given these values and the E/P projections, basic/service ratios were determined using the relationship below:

$$\frac{\text{Population}}{\text{Basic Employment}} = \frac{\text{Population}}{\text{Total Employment}} \times \frac{\text{Total Employment}}{\text{Basic Employment}}$$

While simple, the approach produces plausible basic/service ratios and forces internal consistency in the parameters. The underlying assumption is that productivity growth in the basic sectors will follow the 1960-77 trend in the future.

A. Natural Growth Projections

The natural growth projections contained in Tables 18, 19, and 20 (zero net migration) represent the output of a one year cohort model employing Series II vital rates. The model allows for Indian/White rate differences and also adjusts for transitory groups such as military personnel and university students. Montana vital rates (White) are allowed to converge gradually to national projections by the year 1990. Indian rates follow national projections, but retain the 1970 percentage difference.

The projections have generally been accurate when compared with actual birth patterns. Continued net immigration would, however, reduce the accuracy of the projections. A complete methodology is available from the Montana Department of Community Affairs.

Table 18.--Montana natural growth population projections
(Series II)

1970	694,409
1971	699,570
1972	704,747
1973	709,890
1974	714,976
1975	719,933
1976	725,544
1977	731,791
1978	738,642
1979	746,065
1980	754,003
1981	762,209
1982	770,587
1983	779,017
1984	787,392
1985	795,622
1986	803,587
1987	811,251
1988	818,599
1989	825,653
1990	832,431
1991	838,972
1992	845,293
1993	851,408
1994	857,362
1995	863,227
1996	869,097
1997	875,036
1998	881,103
1999	887,342
2000	893,776

Source: Department of Community Affairs, Research Division, Helena, Montana

Table 19.--Household conversion

Year	Households	Population	Fraction
1960	202,240	674,767	3.00
1970	217,304	694,409	3.13
1975	253,000	746,000	3.39
1976	260,000	755,000	3.44

Source: Bureau of the Census, Series P-25, No 710, October 1977

Note: The recent data represent estimates; Montana estimates indicate an increasing household size while national estimates and projections indicate smaller/declining ratios.

Table 20.--Montana population
(actual and estimated)

1950	591,024
1960	674,767
1970	694,409
1971	709,400
1972	716,100
1973	729,800
1974	737,000
1975	746,000
1976	755,000
1977[p]	761,000

Source: Bureau of the Census, P-26 Series

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